

Appl. No. 10/709,197
Amdt. dated January 26, 2006
Reply to Office action of November 04, 2005

Amendments to the Claims:

This listing of claims will replace all prior versions, all listings, of claims in the application:

Listing of Claims:

5 Claims 1-9 (Cancelled)

Claim 10 (Currently Amended): A proportional_to_Vt voltage amplifier, comprising:

- a transconductance unit for generating a first current according to a first input voltage; and
- 10 a transresistance unit, coupled to a reference voltage, for generating a first output voltage according to the first current, wherein the difference between the first output voltage and the reference voltage is proportional to a thermal voltage;
wherein the transresistance unit comprises:
 - a first transistor for receiving the reference voltage;
 - 15 a second transistor for generating the first output voltage;
a second current mirror coupled to the first transistor and the second transistor;
and
a first bias current source coupled to the first transistor and the second transistor
for providing a first bias current.

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Claim 11 (Original): The proportional_to_Vt voltage amplifier of claim 10, wherein the transconductance unit comprises:

- an operational amplifier having a first input end, a second input end, and an output end, wherein the first input end couples to the first input voltage; and
- 25 a first resistor having one end being coupled to the second input end and the output end of the operational amplifier, and the other end being coupled to ground;
wherein the first current flows through the first resistor.

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Claim 12 (Original): The proportional_to_Vt voltage amplifier of claim 10 further comprising:

a first current mirror, coupled to the transconductance unit, for generating a second current according to the first current.

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Claim 13 (Cancelled)

Claim 14 (Currently Amended): The proportional_to_Vt voltage amplifier of claim [[13]] 10, wherein the second current mirror comprises:

10 a third transistor having a first and a second ends coupled to the first transistor; and
a fourth transistor having a first end coupled to the second transistor and a second end coupled to the gate of the third transistor.

15 Claim 15 (Original): The proportional_to_Vt voltage amplifier of claim 10, wherein
the proportional_to_Vt voltage amplifier is a half circuit of a differential proportional_to_Vt amplifier.

Claim 16 (Currently Amended): A proportional_to_Vt voltage amplifier, comprising:
a transconductance unit for generating a first current according to a first input
20 voltage; and
a transresistance unit, coupled to a reference voltage, for generating a first output voltage according to the first current, wherein the difference between the first output voltage and the reference voltage is proportional to a thermal voltage;
wherein the transconductance unit comprises:

25 ~~an operational amplifier having a first input end, a second input end, and an output end, wherein the first input end couples to the first input voltage; and~~
a first resistor having one end being coupled to the second input end and the output end of the operational amplifier, and the other end being coupled to ground;

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~~wherein the first current flows through the first resistor~~
wherein the proportional to V_t voltage amplifier further comprises a first current mirror coupled between the transconductance unit and the transresistance unit for generating a second current according to the first current, and the
5 transresistance unit comprises a second current mirror coupled to the transconductance unit through the first current mirror.

Claim 17 (Currently Amended): The proportional to V_t voltage amplifier of claim 16,
further comprising:
10 a first current mirror, coupled to the operational amplifier unit, for generating a second current according to the first current
wherein the transconductance unit comprises:
an operational amplifier having a first input end, a second input end, and an output end, wherein the first input end couples to the first input voltage; and
15 a first resistor having one end being coupled to the second input end and the output end of the operational amplifier, and the other end being coupled to ground;
wherein the first current flows through the first resistor.

Claim 18 (Currently Amended): The proportional to V_t voltage amplifier of
20 claim ~~[[17]]~~ 16, wherein the transresistance unit comprises:
a first transistor for receiving the reference voltage;
a second transistor having a first end coupled to the first current mirror, wherein the second transistor is for generating the first output voltage;
~~a second the second~~ current mirror coupled to the first transistor and the second
25 transistor; and
a first bias current source coupled to the first transistor and the second transistor for providing a first bias current.

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Claim 19 (Previously Presented): The proportional_to_Vt voltage amplifier of claim 18,
wherein the second current mirror comprises:

5 a third transistor having a first and a second ends coupled to the first transistor; and
a fourth transistor having a first end coupled to the second transistor and a second
end coupled to the gate of the third transistor.

Claim 20 (Previously Presented): The proportional_to_Vt voltage amplifier of claim 16,
wherein the proportional_to_Vt voltage amplifier is a half circuit of a differential
proportional_to_Vt amplifier.

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Claim 21 (Previously Presented): A proportional_to_Vt voltage amplifier, comprising:

a transconductance unit for generating a first current according to a first input
voltage;

15 a transresistance unit, coupled to a reference voltage, for generating a first output
voltage according to the first current, wherein the difference between the first
output voltage and the reference voltage is proportional to a thermal voltage;
and

a first current mirror, coupled to the transconductance unit, for generating a second
current according to the first current;

20 wherein the transresistance unit further comprises:

a first transistor for receiving the reference voltage;
a second transistor having a first end coupled to the first current mirror,
wherein the second transistor is for generating the first output voltage;
a second current mirror coupled to the first transistor and the second transistor;
25 and

a first bias current source coupled to the first transistor and the second
transistor for providing a first bias current.

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Claim 22 (Previously Presented): The proportional_to_Vt voltage amplifier of claim 21,
wherein the transconductance unit comprises:

- an operational amplifier having a first input end, a second input end, and an output end, wherein the first input end couples to the first input voltage; and
 - 5 a first resistor having one end being coupled to the second input end and the output end of the operational amplifier, and the other end being coupled to ground;
- wherein the first current flows through the first resistor.

- Claim 23 (Previously Presented): The proportional_to_Vt voltage amplifier of claim 21,
- 10 wherein the second current mirror comprises:
 - a third transistor having a first and second ends coupled to the first transistor; and
 - a fourth transistor having a first end coupled to the second transistor and a second end coupled to the gate of the third transistor.

- Claim 24 (Previously Presented): The proportional_to_Vt voltage amplifier of claim 21,
- 15 wherein the proportional_to_Vt voltage amplifier is a half circuit of a differential proportional_to_Vt amplifier.

Claim 25 (New): A variable gain amplifier, comprising:

- a proportional_to_Vt voltage amplifier, comprising:
 - a transconductance unit for generating a first current according to a first input
 - 20 voltage; and
 - a transresistance unit, coupled to a reference voltage, for generating a first output voltage according to the first current, wherein the difference between the first output voltage and the reference voltage is proportional to a thermal voltage;
- 25 a gain controlling stage for generating a gain controlling voltage to control a voltage gain of the variable gain amplifier according to the first output voltage; and
- an amplifying stage for providing the voltage gain of the variable gain amplifier

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according to the gain controlling voltage;
wherein the voltage gain is independent of the thermal voltage.

5 Claim 26 (New): The variable gain amplifier of claim 25, wherein the voltage gain changes linearly in decibel in response to the gain controlling voltage.

10 Claim 27 (New): The variable gain amplifier of claim 25, wherein the transconductance unit comprises:
an operational amplifier having a first input end, a second input end, and an output end, wherein the first input end couples to the first input voltage; and
a first resistor having one end being coupled to the second input end and the output end of the operational amplifier, and the other end being coupled to ground;
wherein the first current flows through the first resistor.

15 Claim 28 (New): The variable gain amplifier of claim 25 further comprising a first current mirror coupled between the transconductance unit and the transresistance unit.

20 Claim 29 (New): The variable gain amplifier of claim 25, wherein the transresistance unit comprises:
a first transistor for receiving the reference voltage;
a second transistor for generating the first output voltage;
a second current mirror coupled to the first transistor and the second transistor; and
a first bias current source coupled to the first transistor and the second transistor for providing a first bias current.

25 Claim 30 (New): The variable gain amplifier of claim 25, wherein the amplifying stage couples to the gain controlling stage by using a current mirror structure.